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(54) **VENTURI APPARATUS WITH A FLUID FLOW REGULATOR VALVE**

(75) Inventors: **Rio Sabadicci**, Rancho Santa Fe, CA (US); **Larry D. Nelson**, Carlsbad, CA (US)

(73) Assignee: **Focus Products Group International, LLC**, Lincolnshire, IL (US)

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B01F 3/04 (2006.01)
B01F 13/00 (2006.01)

(52) **U.S. Cl.**
CPC ***B01F 3/0446*** (2013.01); ***B01F 5/0428*** (2013.01); ***B01F 13/002*** (2013.01); *B01F 2215/0072* (2013.01)

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USPC 366/173.1, 174.1, 175.2, 181.8, 182.4, 366/182.2, 163.1, 163.2, 167.1, 176.1, 337, 366/181.5; 137/888–896
See application file for complete search history.

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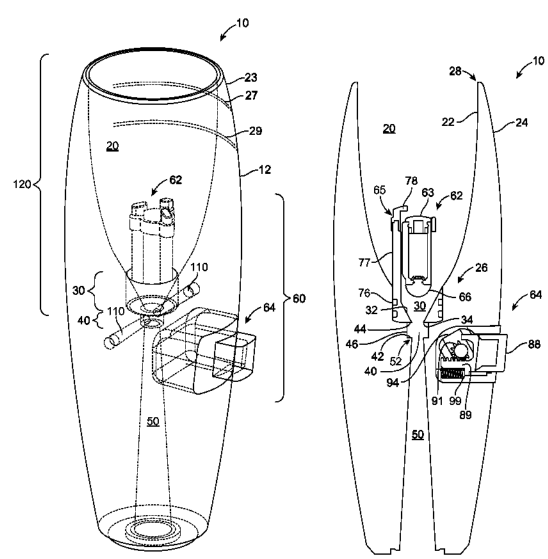
Primary Examiner — Charles Cooley
(74) *Attorney, Agent, or Firm* — Thompson Coburn LLP

(57) **ABSTRACT**

A Venturi apparatus includes: a body defining a receptacle chamber configured to receive a first fluid, a transition passageway in fluid communication with the receptacle chamber and configured to receive the first fluid from the receptacle chamber, a mixing chamber in fluid communication with the transition passageway and configured to receive the first fluid from the transition passageway, and a sidearm passageway in fluid communication with the mixing chamber and extending to an outer surface of the body and configured to allow a second fluid to pass from an exterior of the into the mixing chamber; and a fluid flow regulator connected to the body, configured to affect a flow of the first fluid from the receptacle chamber into the mixing chamber, and including a valve mechanism configured to selectively engage the body to inhibit flow of the first fluid from the receptacle chamber into the mixing chamber.

17 Claims, 9 Drawing Sheets



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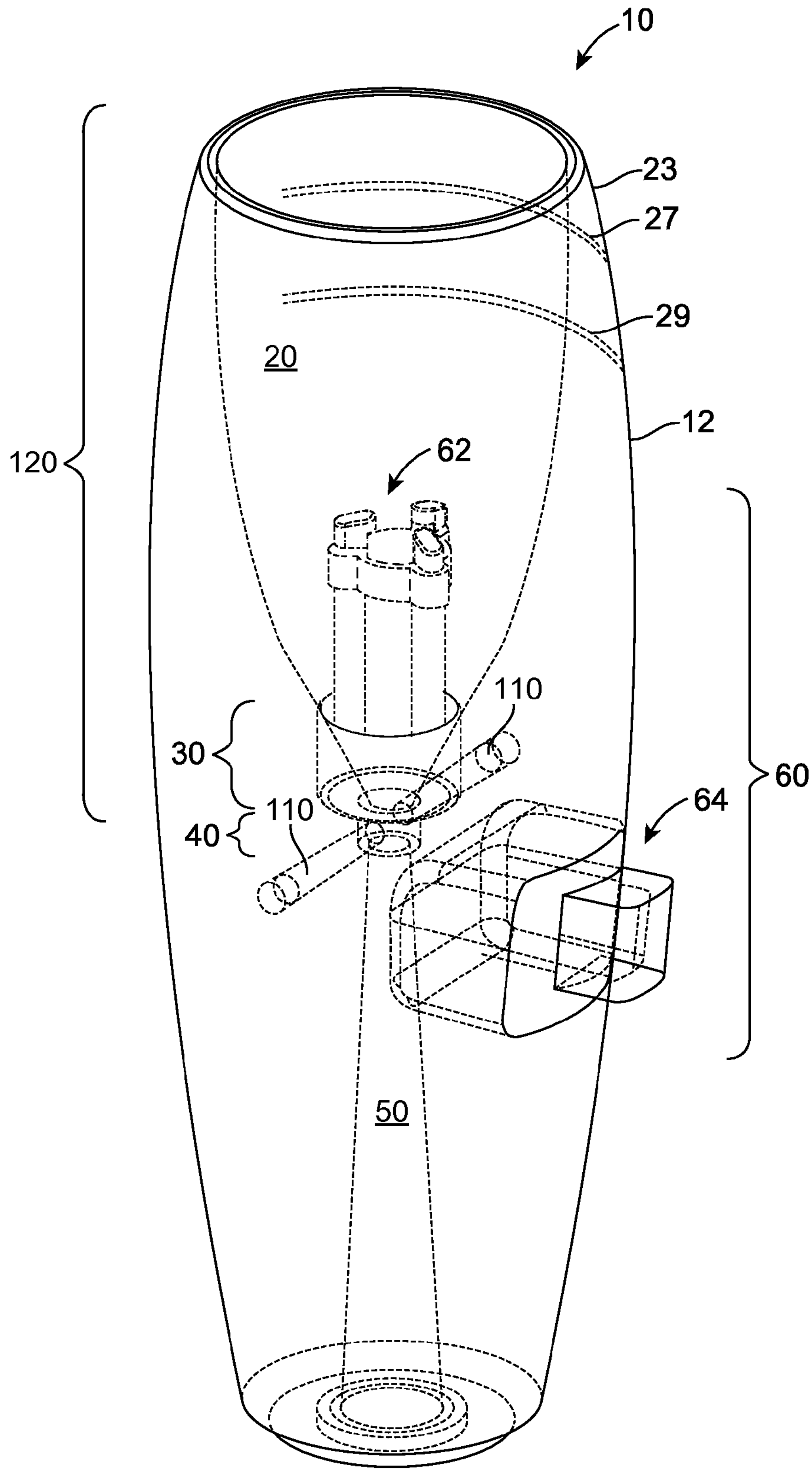

FIG. 1

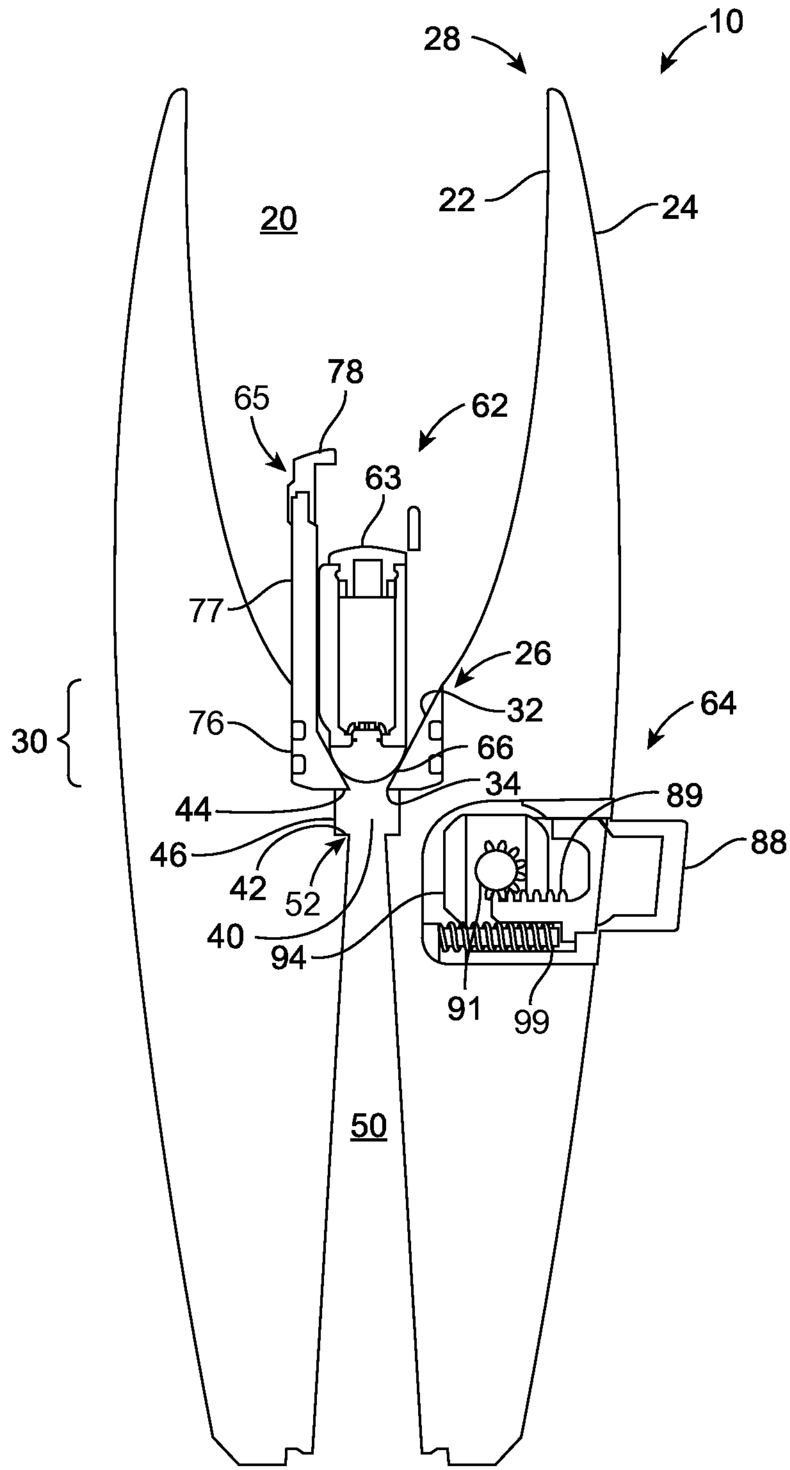

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FIG. 2

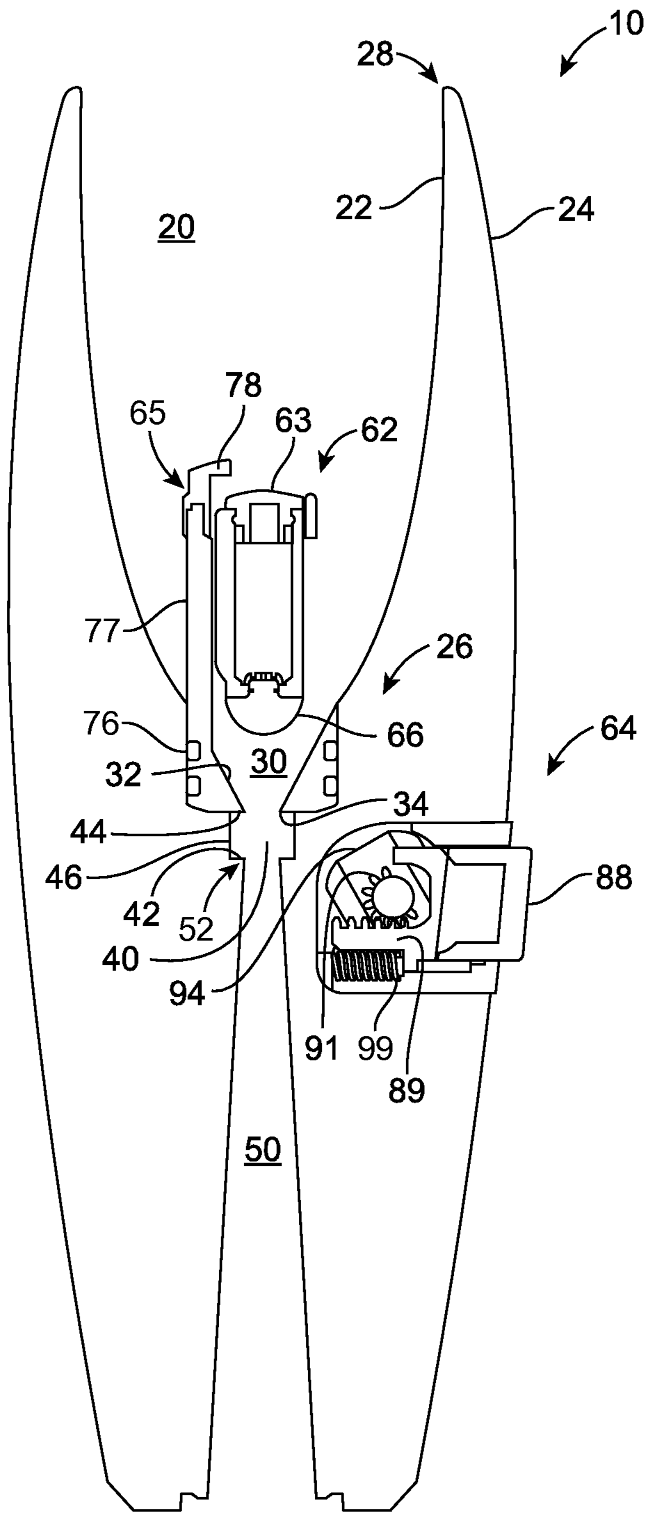
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FIG. 3

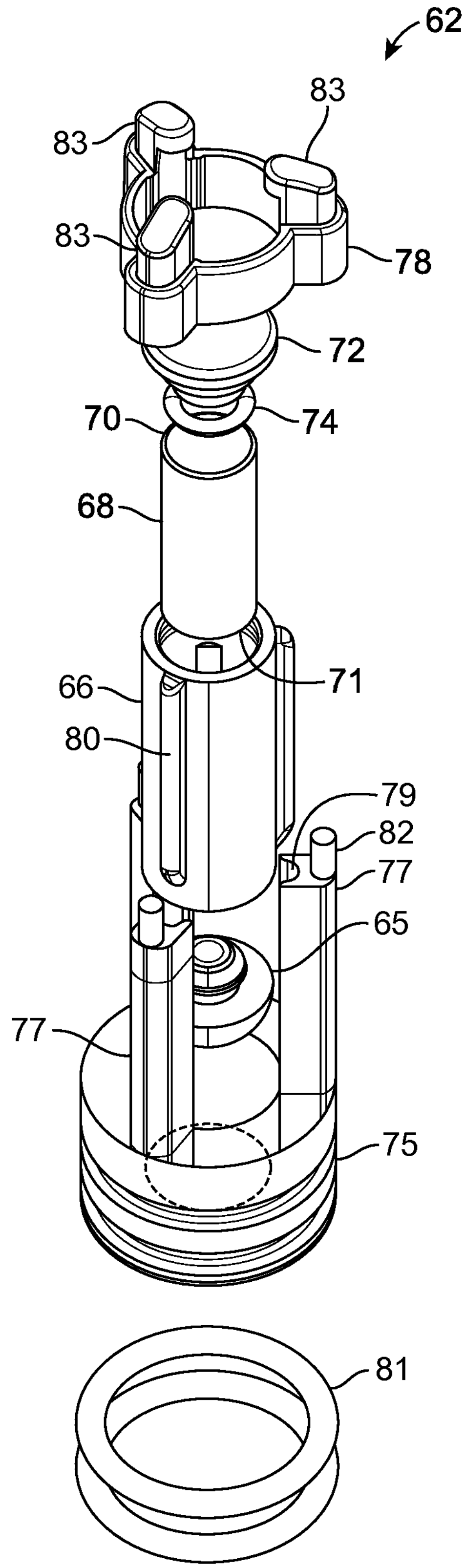

FIG. 4

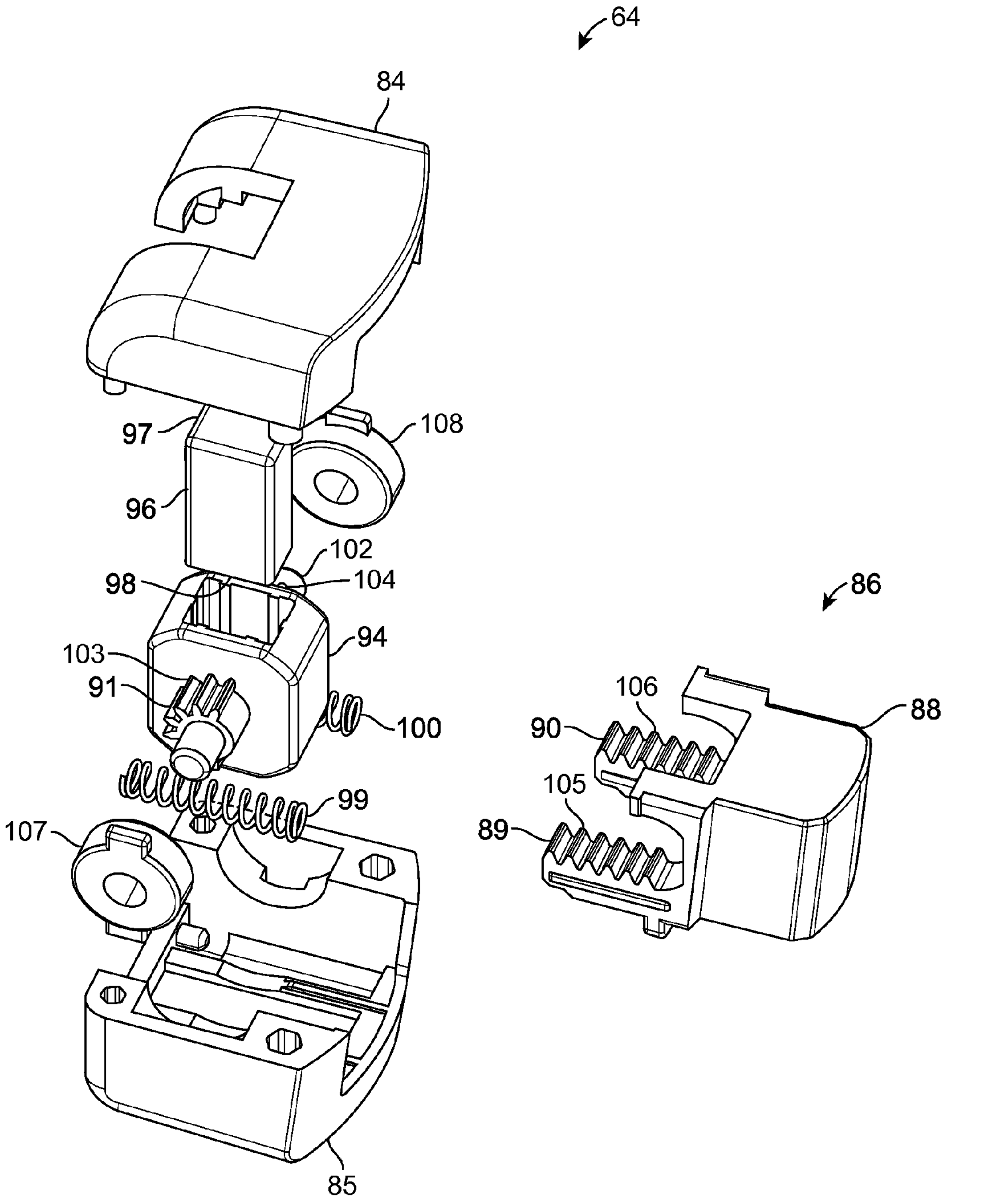
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FIG. 5

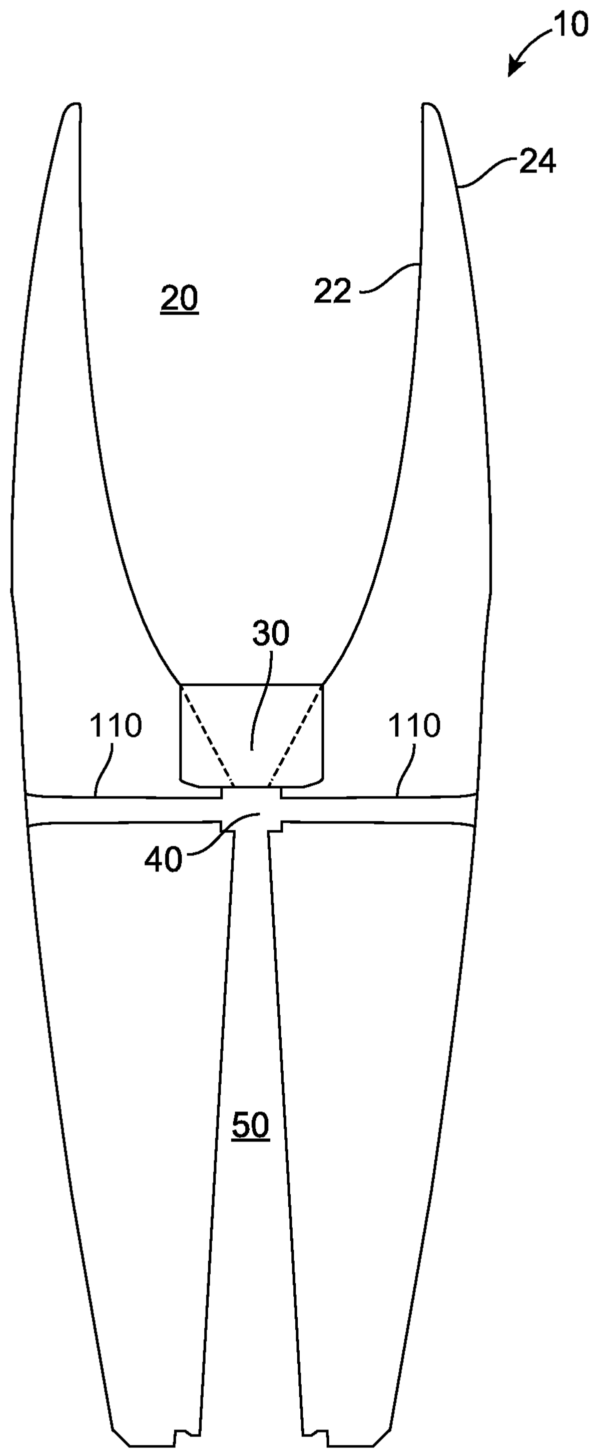

FIG. 6

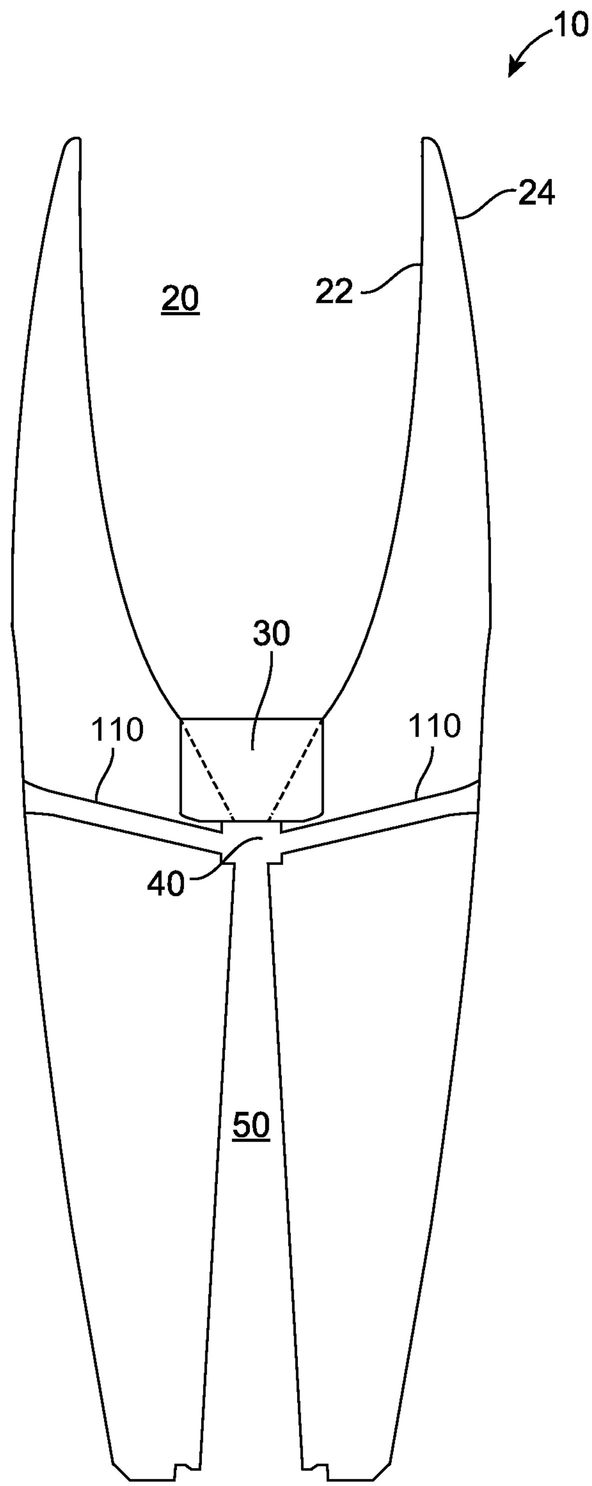

FIG. 7

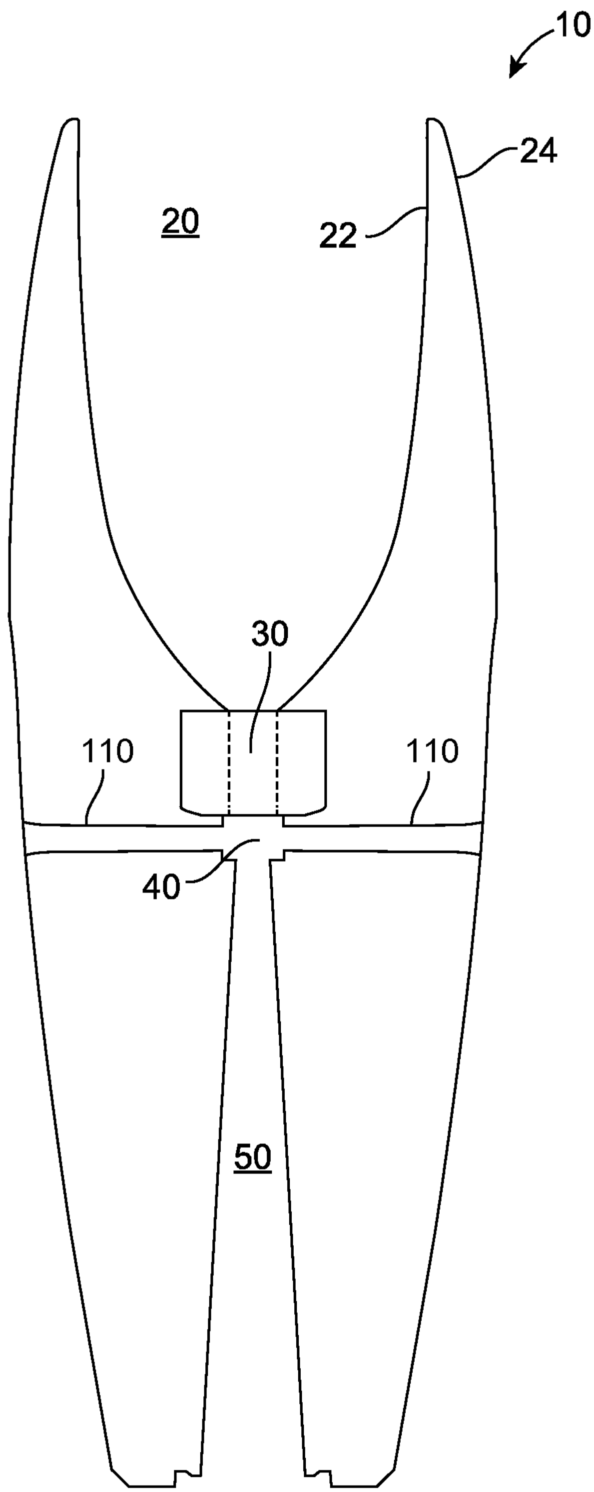

FIG. 8

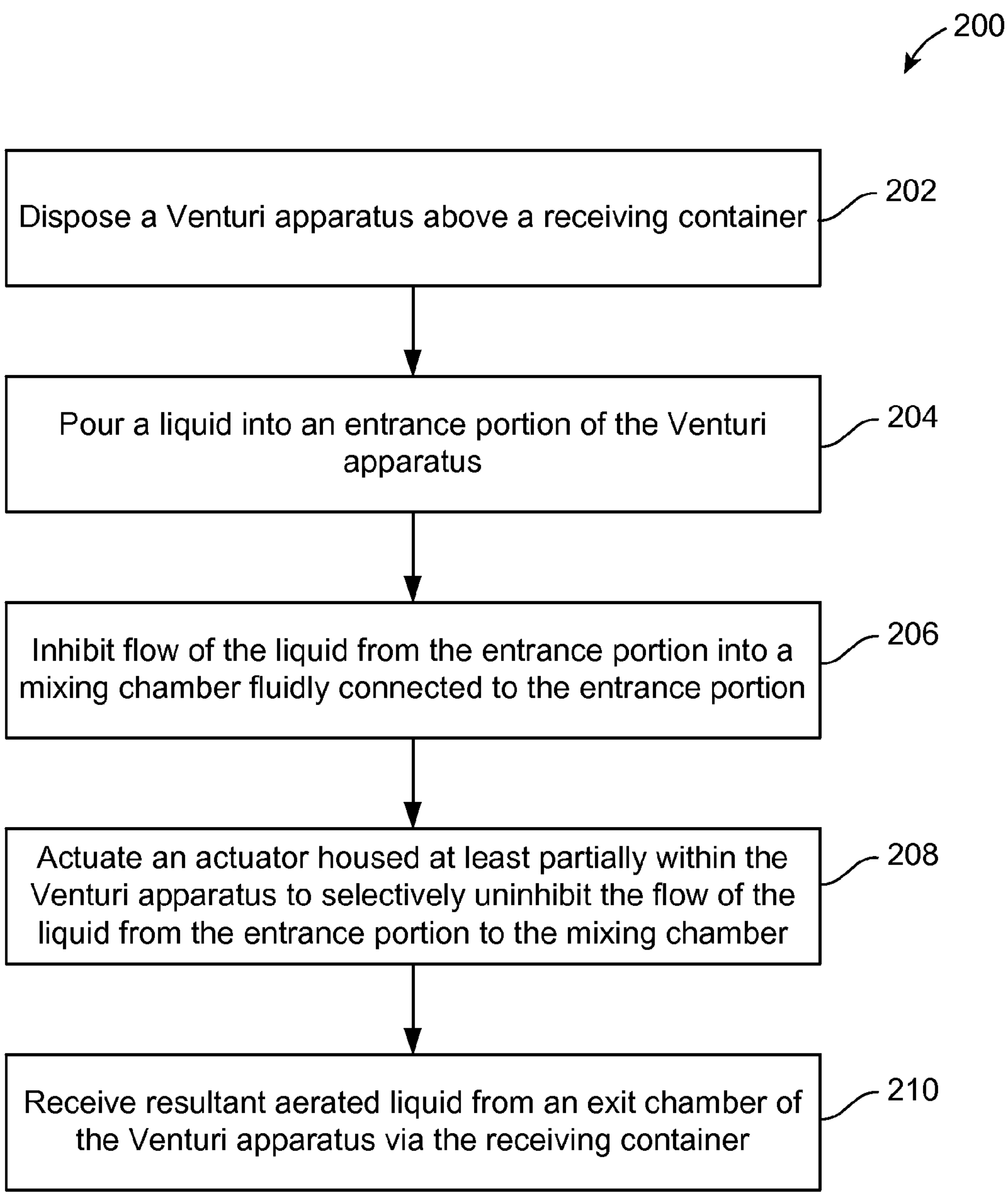
200
Dispose a Venturi apparatus above a receiving container
202
Pour a liquid into an entrance portion of the Venturi apparatus
204
Inhibit flow of the liquid from the entrance portion into a mixing chamber fluidly connected to the entrance portion
206
Actuate an actuator housed at least partially within the Venturi apparatus to selectively uninhibit the flow of the liquid from the entrance portion to the mixing chamber
208
Receive resultant aerated liquid from an exit chamber of the Venturi apparatus via the receiving container
210

FIG. 9

VENTURI APPARATUS WITH A FLUID FLOW REGULATOR VALVE

CROSS-REFERENCES TO RELATED APPLICATIONS

This application claims benefit of priority from U.S. Provisional Patent Application No. 61/449,601, filed Mar. 4, 2011, entitled "VENTURI APPARATUS."

BACKGROUND

Venturi-type devices typically comprise fittings or tubular structures, and in particular pipe structures, that are constricted in the middle and flared on both ends. When a fluid, such as a gas or liquid, is passed through the Venturi device, the fluid's velocity increases whereas the fluid's pressure correspondingly decreases. Such devices are used in a variety of applications, including measuring fluid flow or for creating suction as for driving aircraft instruments or drawing fuel into the flow stream of a carburetor.

One application of a Venturi device is for mixing or combining of a second fluid with a first fluid passing through the Venturi device. For instance, a Venturi device known as a Vinturi® may be used for aeration of a liquid, such as wine. The Vinturi accepts the liquid to be aerated at an upper receptacle portion. The liquid flows downward through the receptacle portion of the with the aid of gravity into an intermediate mixing chamber, into which air is introduced via sidearm passageways. The cross-sectional area of the mixing chamber in relation to the cross-sectional area of the bottom of the receptacle chamber creates a pressure differential between the mixing chamber and the atmosphere outside the Vinturi. This pressure differential causes the air to be introduced into the mixing chamber and mix into the liquid flowing through the mixing chamber. The resulting mixture of liquid and air exits through a bottom of the intermediate mixing chamber via gravity into an exit chamber, from which the mixture exits the Vinturi.

SUMMARY

An example of a Venturi apparatus for facilitating the mixture of two or more fluids according to the disclosure includes a body defining a receptacle chamber configured to receive a first fluid, a transition passageway disposed below and in fluid communication with the receptacle chamber and configured to receive the first fluid from the receptacle chamber, a mixing chamber disposed below and in fluid communication with the transition passageway and configured to receive the first fluid from the transition passageway, and a sidearm passageway in fluid communication with the mixing chamber and extending to an outer surface of the body and configured to allow at least a second fluid to pass from an exterior of the body through the sidearm passageway into the mixing chamber. A top cross-sectional area of the mixing chamber is greater than a bottom cross-sectional area of the first passageway. The Venturi apparatus further includes a fluid flow regulator connected to the body and configured to affect a flow of the first fluid from the receptacle chamber into the mixing chamber. The fluid flow regulator includes a valve mechanism configured to selectively engage the body to inhibit flow of the first fluid from the receptacle chamber into the mixing chamber.

Implementations of the Venturi apparatus may include one or more of the following features. The receptacle chamber, the first passageway and the mixing chamber are configured to pass the first fluid therethrough with the receptacle chamber, the first passageway and the mixing chamber disposed in vertical alignment and the first fluid subjected to gravity. The valve mechanism includes a plunger housing fixedly mounted to the body and a plunger slidably coupled with the plunger housing, and the plunger housing defines a path of movement of the plunger. The plunger housing includes a guide portion and a retainer portion connected to and disposed above the guide portion. The retainer includes a plurality of horizontal prongs which extend over the plunger to restrict vertical travel of the plunger as the plunger moves along the path of movement. The plunger is positionable within the plunger housing in a closed position, in which the plunger engages at least a portion of a wall of the transition passageway to substantially obstruct fluid flow through the first passageway and into the mixing chamber, and an open position, in which the plunger is displaced from the wall of the transition passageway to permit flow of the first fluid through the first passageway and into the mixing chamber. The plunger includes a plunger tip providing a bottom surface of the plunger and having a shape corresponding to the at least a portion of the wall of the transition passageway and a cross sectional area greater than a cross sectional area of the at least a portion of the transition passageway.

Implementations of the Venturi apparatus may additionally or alternatively include one or more of the following features. The fluid flow regulator further includes an actuator that is physically separated from the plunger and is configured to actuate the plunger to slide relative to the plunger housing. The plunger includes a first magnet, and the actuator includes a second magnet rotatably coupled to the body. The actuator further includes an actuator member movably coupled to the body and configured to cause, when moved relative to the body, the second magnet to rotate from a first orientation biasing the plunger into a closed position to a second orientation biasing the plunger into an open position. The actuator further includes an actuator housing and a magnet housing containing the second magnet, the actuator member is movably coupled to the actuator housing and includes a plurality of arms disposed along a bottom portion of the actuator member and slidably coupled to an interior of the actuator housing, the actuator member is positionable relative to the actuator housing in an actuated position and an unactuated position, and the magnet housing is pivotably coupled to the actuator housing by a plurality of pivot pins extending from opposing sides of the magnet housing. Each of the plurality of pivot pins includes cogs having first teeth disposed along at least a portion of the circumference of the pin, and each of the plurality of arms includes second teeth that are sized, shaped and disposed corresponding to the first teeth such that the first teeth mesh with the second teeth. The second teeth of the arms are configured to interact with the first teeth of the pivot pins to rotate the pivot pins when the actuator member moves between the unactuated position and the actuated position, thereby rotating the second magnet between the first orientation when the actuator member is in the unactuated position and the second orientation when the actuator member is in the actuated position. In the first orientation, the second magnet has a first pole closer to the plunger than a second pole, and in the second orientation has the second pole closer to the plunger than the first pole, the first pole having a magnetic polarity opposite to a magnetic polarity of a bottom pole of the first magnet. The first teeth and second teeth are configured and the actuator member has sufficient travel relative to the pivot pins such that movement of the actuator member causes rotation of the second magnet between the first orientation and the second orientation. The actuator further

includes a return spring configured and disposed to bias the actuator member into the unactuated position.

Still other implementations of the Venturi apparatus may include one or more of the following features. The fluid flow regulator includes a valve mechanism and an actuator that is physically separate from the valve mechanism and is configured to actuate the valve mechanism contactlessly, without direct physical contact between the actuator and the valve mechanism. The sidearm passageway is a first sidearm passageway, the body further defining a second sidearm passageway, the first and second sidearm passageways being disposed within the body aligned along a common plane and fluidly connected to a median of the mixing chamber, and each of the plurality of sidearm passageways includes an outer opening that is open to the atmosphere and permits entry of atmospheric gases and an inner opening that opens into the mixing chamber. The receptacle chamber is open to the atmosphere. The body further defines an exit chamber disposed below and in fluid communication with the mixing chamber and configured to receive a mixture of the first fluid and the second fluid from the mixing chamber, and a bottom cross-sectional area of the mixing chamber is greater than a top cross-sectional area of the exit chamber.

An example of a method of aerating a liquid according to the disclosure includes disposing a Venturi apparatus above a receiving container, pouring the liquid into an entrance portion of the Venturi apparatus, inhibiting flow of the liquid from the entrance portion into a mixing chamber fluidly connected to the entrance portion, actuating an actuator housed at least partially within the Venturi apparatus to selectively uninhibit the flow of the liquid from the entrance portion to the mixing chamber and permit mixture within the mixing chamber between the liquid and atmospheric gases, thereby obtaining aerated liquid, and receiving the aerated liquid from an exit chamber of the Venturi apparatus via the receiving container.

Implementations of the method may include one or more of the following features. The pouring includes pouring the liquid into the entrance portion of the Venturi apparatus while the Venturi apparatus is situated substantially vertically, thereby permitting the liquid to flow through the Venturi apparatus due to gravity. The inhibiting includes substantially obstructing the flow of the liquid from the entrance portion into the mixing chamber. The inhibiting further includes magnetically biasing a plunger into contact with a body of the Venturi apparatus. The actuating includes magnetically biasing the plunger away from contact with the body. The liquid includes at least one of wine or a spirit. The disposing includes disposing the Venturi apparatus above the receiving container such that the entrance portion of the Venturi apparatus is open to the atmosphere. The disposing includes fluidly connecting the entrance portion of the Venturi apparatus to a container holding the liquid.

An example of a Venturi apparatus for facilitating the mixture of a liquid with a gas according to the disclosure includes a body defining a receptacle chamber configured to receive the liquid, a mixing chamber disposed below and in fluid communication with the receptacle chamber and configured to receive the liquid, and a sidearm passageway in fluid communication with the mixing chamber and extending to an outer surface of the body, and configured to allow the gas to pass from an exterior of the body adjacent to the outer surface into the mixing chamber. The Venturi apparatus further includes flow regulating means for selectively inhibiting flow of the liquid from the receptacle chamber to the mixing chamber and for selectively permitting flow of the liquid from the receptacle chamber to the mixing chamber, the flow regulating means comprising valve means and actuating means for actuating the valve means, without physical contact with the valve means, to selectively inhibit or selectively permit flow of the liquid from the receptacle chamber to the mixing chamber.

Implementations of the Venturi apparatus may include one or more of the following features. The actuating means includes a first magnet coupled to the valve means and a second magnet coupled to an actuating member movably coupled to the body.

BRIEF DESCRIPTION OF THE DRAWINGS

Features and advantages of the various embodiments disclosed herein will be better understood with respect to the following description and drawings.

FIG. **1** is an elevated perspective view of a housing incorporating an improved Venturi apparatus.

FIG. **2** is a cross-sectional view of the apparatus shown in FIG. **1** in a closed position.

FIG. **3** is a cross-sectional view of the apparatus shown in FIG. **1** in an open position.

FIG. **4** is an exploded view of a valve mechanism of the apparatus shown in FIG. **1**.

FIG. **5** is an exploded view of an actuator mechanism of the apparatus shown in FIG. **1**.

FIG. **6** is a cross-sectional view of sidearm passageways of the apparatus shown in FIG. **1** in a perpendicular configuration.

FIG. **7** is a cross-sectional view of sidearm passageways of the apparatus shown in FIG. **1** in a descending configuration.

FIG. **8** is a cross-sectional view of a Venturi apparatus comprising a non-tapered funnel-mixing chamber passageway.

FIG. **9** is a block flow diagram of a process for aerating a liquid.

DETAILED DESCRIPTION

Various examples of Venturi apparatus are described herein. For example, a Venturi apparatus is structured to utilize the Venturi effect to facilitate the mixture of fluids, such as a liquid and a gas. The Venturi apparatus can mix air with an alcoholic liquid such as hard liquor (spirits) or wine, though other liquids and/or gasses could be used.

An example Venturi apparatus comprises multiple sections that combine to define a fluid passageway that selectively allows a fluid to pass through the apparatus downwardly when the apparatus is oriented substantially vertically. A receptacle section comprises a generally funnel-type chamber for receiving a first fluid. The receptacle section channels the first fluid through a first passageway into a mixing chamber, where a second fluid is mixed with the first fluid. The resulting fluid mixture then flows from the mixing chamber into an exit chamber from which the mixture exits the Venturi apparatus.

A valve mechanism is positioned within the receptacle section and comprises a plunger that regulates the flow of the first fluid through the receptacle section and the first passageway. The plunger is positionable via an actuator in a first, closed position to engage the first passageway to obstruct the flow of the first fluid and in a second, open position to provide little if any resistance to such flow. The actuator is magnetically coupled to the valve mechanism and controls the position of the plunger by manipulating the orientation of a magnet housed within the actuator relative to that of a magnet housed within the plunger.

Referring to FIG. **1**, there is perspectively illustrated an improved Venturi apparatus **10** that is operative to facilitate the mixture of two or more fluids. The term "fluid" as used herein can comprise any fluid-type substance and includes any type of liquid or gas, as well as materials caused to assume either a liquid or gaseous state as may be caused by the application of either heat and/or pressure, and thus includes condensates and vaporized or melted materials. By way of example, and not limitation, a fluid as referred to herein includes air, water, alcoholic beverages such as wine and/or spirits, etc.

The improved Venturi apparatus **10** comprises a body **12** that includes or defines several sections or portions, namely, a receptacle chamber **20**, transition passageway **30**, a mixing chamber **40**, two sidearm passageways **110**, an exit chamber **50**, and a fluid flow regulator **60**, all of which are discussed more fully below. The sections **20**, **30**, **40**, **50** are in fluid communication with each other and configured to direct at least one first fluid to flow through the receptacle chamber **20**, the transition passageway **30**, the mixing chamber **40**, and the exit chamber **50** and to cause at least one second fluid, via the passageways **110**, to be drawn into the mixing chamber **40**. The first and second fluids are combined in the mixing chamber **40** and exit the apparatus **10** via the exit chamber **50**. The fluid flow regulator **60** regulates flow of the first fluid from the receptacle chamber **20** into the transition passageway **30** and beyond. The apparatus **10** is configured to be disposed substantially vertically in operation, with the receptacle **20** above the transition passageway **30**, the transition passageway **30** above the mixing chamber **40**, and the mixing chamber **40** above the exit passageway **50**, such that a first fluid introduced (e.g., a liquid poured) into the receptacle chamber **20** under forces of atmospheric pressure and gravity alone will flow from the receptacle chamber **20** into the transition passageway **30**, the mixing chamber **40**, and the exit chamber **50**, when the fluid flow regulator **60** permits, with sufficient speed to induce a second fluid (e.g., a gas such as air) from outside the apparatus **10** to flow through the sidearm passageways **110** into the mixing chamber **40** and mix with the first fluid.

Referring also to FIG. **2**, the receptacle chamber **20** is a generally funnel-type chamber defined by an interior wall **22** of a receptacle portion **24**. The chamber **20** provides an opening for receiving a first fluid. The first fluid may comprise either a single fluid or a mixture of fluids. The term "funnel-type" as used herein refers to any uniform or non-uniform, regular or irregular chamber structure possessing a tapered configuration with a cross-sectional area at a bottom end **26** that is smaller than a cross-sectional area at a top end **28** of the chamber **20**. Preferably, the chamber **20** has a progressively decreasing cross-sectional area. Here, the chamber **20** has a truncated ovate shape. Other shapes, however, may be used such as frusto-conical, polyhedral, truncated obovate, semi-spherical, etc. The receptacle section **20** is configured to cause acceleration of the first fluid through the receptacle section **20** with the first fluid subject to atmospheric pressure and gravity. Here, the chamber **20** is open to the atmosphere; however, the chamber **20** may alternatively be structured such that it is in direct fluid communication with an external body, such as a bottle containing the first fluid.

The receptacle section **20** is configured to channel the first fluid to the transition passageway **30** that is disposed below and fluidly coupled to the receptacle section **20**. The transition passageway **30** is defined by a smooth, rounded surface **32** and is operative to normalize fluid flow and thus reduce fluid turbulence. Here, the transition passageway **30** has a frusto-conical structure; however, the transition passageway **30** can alternatively have a regular or irregular, tapered or non-tapered structure, such as a cylindrical structure. Together, the receptacle section **20** and the transition passageway **30** collectively form an entrance section **120** from which the first fluid flows into the mixing chamber **40**.

The mixing chamber **40** is disposed below the transition passageway **30**. As illustrated, the mixing chamber **40** is provided with a generally planar floor **42** and a generally planar ceiling **44** as well as a midsection **46** having a cross-sectional area that is greater than a cross-sectional area of a bottom **34** of the transition passageway **30**. There is an abrupt transition in cross-sectional area from the transition passageway **30** to the mixing chamber **40**. The mixing chamber **40** is configured such that the first fluid passing from the transition passageway **30** to the mixing chamber **40** will induce a pressure differential between the mixing chamber and the atmosphere outside the apparatus **10**. This pressure differential will create a vacuum force that causes a second fluid to be drawn into the mixing chamber **40** through the sidearm passageways **110** as shown.

The exit chamber **50** facilitates the mixture between the fluids and directs the mixture to the bottom of the apparatus **10** to exit the apparatus **10** and be received by an appropriate receptacle, such as a glass (e.g., wine glass, shot glass, tumbler, etc.). Similar to the receptacle chamber **20**, the exit chamber **50** can be constructed using any suitable uniform or non-uniform structure or combination of structures. Here, the exit chamber **50** comprises a tapered frusto-conical structure with a widening cross-sectional area. Alternatively, the exit chamber **50** can be cylindrical, semi-ovate, polyhedral, etc. Preferably, as here, a cross-sectional area of a top **52** of the exit chamber **50** is less than a bottom cross-sectional area of the mixing chamber **40**, i.e., a cross-sectional area of the floor **42** of the mixing chamber **40**. This variance in cross-sectional area contributes to the mixture of fluids within the apparatus **10** by causing a change in relative pressure as the available volume expands while additionally extending the contact time between the mixed fluids within the exit chamber **50** as the liquids pass therethrough. The structure of the exit chamber **50** additionally affects the velocity of the fluids passing through the apparatus **10**, including the exit chamber **50** in addition to sections **20**, **30**, and **40**.

An exterior wall **23** of the receptacle portion **24** includes markings **27**, **29** provided along the surface of the Venturi apparatus **10**, although these markings **27**, **29** are optional. The markings **27**, **29** indicate standardized measurements (e.g., in fluid ounces or fractions of fluid ounces) of the first fluid within the receptacle chamber **20**. Here, the lower marking **27** indicates a portion of the receptacle chamber **20** having a capacity of one fluid ounce and the upper marking **29** indicates a portion of the receptacle chamber **20** having a capacity of one and a half fluid ounces. Other or additional markings could also be used. Additionally, a total fluid capacity of the receptacle chamber **20** can also correspond to a standard measurement. Here, the fluid capacity from the bottom **26** to the top **28** of the receptacle chamber **20** is two ounces. Other sizes could also be utilized.

The fluid flow regulator **60** includes a valve mechanism **62** positioned within the receptacle portion **20** and an actuator **64** at least partially housed within the apparatus **10**. The valve mechanism **62** is controlled via the actuator **64** to regulate flow of the first fluid through the receptacle portion **20**, the transition passageway **30** and the mixing chamber **40**. The actuator **64** is contactless relative to the valve mechanism **62**, such that the actuator **64** is not in direct physical contact with the valve mechanism **62**.

The valve mechanism **62** comprises a plunger **63** that is slidably coupled with a plunger housing **65** that is fixedly mounted within the apparatus **10** to the receptacle wall **24**. Referring also to FIG. **4**, the plunger **63** includes a generally tubular magnet housing **66** and a tip **67** fastened to a bottom end of the magnet housing **66**. The plunger tip **67** has a shape corresponding to (to mate with or match) a shape of the transition passageway **30**. Here, the plunger tip **67** is domed; however, the plunger tip **67** could be any other shape or combination of shapes, e.g., cylindrical, frusto-conical, rounded conical, partially obovate, etc., such that the plunger tip **66** corresponds to the shape of the transition passageway **30**. Further a cross-sectional area of some part of the plunger tip **67** is larger than a cross-sectional area of some part of the transition passageway **30**, thereby causing the plunger **63** via the plunger tip **67** to interfere with and contact a wall of the passageway **30** to inhibit, and preferably prevent, the passage of the first fluid through the transition passageway **30** when the plunger **63** is in a closed position, as described below. The plunger tip **67** is composed of a substantially rigid material that is shaped to correspond to the shape of the transition passageway **30** and sufficiently weighted to provide a substantially fluid-tight seal between the transition passageway **30** and the mixing chamber **40** when the plunger tip **67** is received within the body **12** of the apparatus **10**, e.g., at the transition passageway **30**. Here, stainless steel is disposed within an interior of the plunger tip **67** to increase the weight of the plunger **63** and improve the sealing performance of the valve mechanism **62**. Other materials could also be utilized. As an alternative to a rigidly constructed plunger tip **67**, the plunger tip **67** may also be composed of a flexible material such that the shape of the plunger tip **67** at least partially conforms to the shape of the transition passageway **30** when closed.

The plunger **63** includes a magnet **68** positioned within the magnet housing **66**. The magnet **68** is disposed above the plunger tip **67** and is fixedly connected (e.g., glued or otherwise held in a fixed position) within the magnet housing **66**. The magnet has a first pole **70**, here its south pole, disposed opposite to the plunger tip **67** and a second pole **71**, here its north pole, disposed adjacent to the tip **67**. The magnet **68** is a rare earth magnet or other suitably manufactured magnetic object. To prevent contact between the magnet **68** and fluids flowing through the apparatus **10**, the magnet is nickel plated and/or otherwise coated, e.g., with a substantially magnetically inert material. Here, the shape of the magnet **68** substantially matches that of the magnet housing **66**. However, the magnet **68** may be of any shape (e.g., conical or frusto-conical, polyhedral, etc.), provided it is at least partially positionable within the magnet housing **65** and the shape of the magnet **68** defines a magnetic field that enables the fluid flow regulator **60** to operate in a predictable and controlled manner.

A cap **72** is fastened to a top end of the magnet housing **66** and, together with the magnet housing **66** and the plunger tip **67**, fully enclose the magnet **68** such that the magnet **68** does not directly contact the first fluid flowing through the apparatus **10**. To restrain the position of the magnet **68** within the magnet housing **66** and to facilitate the connection between the magnet housing **66** and the cap **72**, one or more O-rings **74** are disposed between the cap **72** and the magnet **68**. While not shown in FIG. **4**, one or more O-rings may also be disposed between the magnet **68** and the plunger tip **67**.

A path of movement of the magnet housing **66** within the valve mechanism **62** is defined via the plunger housing **65**. The plunger housing **65** comprises a lower guide portion **75**, an upper guide portion **76** fixably connected to and disposed above the lower guide portion **75**, and a retainer portion **78** fixably connected to and disposed above the upper guide portion **76**. For purposes of illustration, FIGS. **2** and **3** show partial cut-away views of the plunger housing **65** that illustrate the plunger housing **65** on the left side and the transition passageway **30** on the right side. However, as shown in FIG. **4**, the plunger housing **65** is configured to receive the plunger **63** at regular angles substantially surrounding a perimeter of the plunger **63**.

The lower guide portion **76** is a substantially outwardly cylindrical structure that is fixably situated within the apparatus **10**, e.g., at the time of manufacture. The lower guide portion **76** comprises an inner opening through which the transition passageway **30** is defined. One or more O-rings **81** are disposed above and/or below the lower guide portion **76**. The upper guide portion **76** comprises a plurality of elongated members **77**. Here, the upper guide portion **76** has three members **77**, though other quantities of the members **77** are possible. The members **77** of the upper guide portion **76** are inset with grooves **79** that mesh with respective raised strips **80** positioned along the perimeter of the magnet housing **66**, thereby slidably coupling the magnet housing **66** to the upper guide portion **76**. The retainer portion **78** fastens to the upper guide portion **76** via tabs **82** positioned at the top of each elongated member of the upper guide portion **76**. The retainer portion **78** comprises horizontal prongs **83** corresponding to the elongated members **77** of the upper guide portion **76**, which extend over the plunger **63** to restrict vertical travel (i.e., define a maximum vertical displacement) of the plunger **63** as it moves about the upper guide portion **76**.

The lower guide portion **76**, along with the upper guide portion **76** and the retainer, collectively define a laterally restricted range of motion of the plunger **63**. More particularly, interference between the tip **67** of the plunger **63** and the lower guide portion **76** defines a lower vertical displacement or position of the plunger **63**, while interference between the retainer **78** and the cap **72** of the plunger **63** defines an upper vertical displacement or position.

The plunger **63** is positionable in a first, closed position, shown in FIG. **2**, to engage a wall of the transition passageway **30** to substantially obstruct fluid flow through the transition passageway **30** and into the mixing chamber **40**. As used herein, “substantially obstruct” refers to an obstruction of at least approximately 90 percent of the fluid flow between the entrance section **120** to the mixing chamber **40**, and more preferably at least approximately one of 91 percent, 92 percent, 93 percent, 94 percent, 95 percent, 96 percent, 97 percent, 98 percent, or 99 percent, and even more preferably approximately 100 percent. The plunger **63** is also positionable in a second, open position, shown in FIG. **3**, to permit flow of the first fluid into the transition passageway **30** with little if any resistance to such flow by the plunger **63** such that a flow of the first fluid through the apparatus **10** with the plunger **63** in the open position will cause the second fluid to be mixed with the first fluid in the mixing chamber **40**. Other configurations of the valve mechanism **62**, e.g., corresponding to intermediate positions of the plunger **63**, can also be used to provide varying fluid flow amounts. As described above, movement of the plunger **63** within the receptacle section **20** and the transition passageway **30** is restricted laterally by the plunger housing **65**.

The actuator **64** is configured to magnetically actuate the plunger **63** to move the plunger **63** between the closed position and the open position. Here, the actuator **64** is configured to actuate the plunger **63** contactlessly, without direct physical contact between the actuator **64** and the plunger **63** or any other portion of the valve mechanism **62**. Referring to FIG. **5**, the actuator **64** includes an upper housing **84** and a lower housing **85**. The upper housing **84** and lower housing **85** collectively enclose at least some of the components of the actuator **64** described below and are fixably positioned within the apparatus **10** such that a front-facing edge of the upper housing **84** and lower housing **85** substantially align with the body **12** of the apparatus **10**. The actuator **64** is isolated from the fluids flowing through the apparatus **10**. In particular, the apparatus **64** is physically separated from the sidearm passageways **110**, the receptacle chamber **20**, the transition passageway **30**, the mixing chamber **40** and the exit chamber **50** such that the actuator **64** is not in fluid communication with any of these sections **20**, **30**, **40**, **50**, **110**. A magnet housing **94** is disposed between the upper housing **84** and lower housing **85**. The magnet housing **94** comprises an opening configured to receive a magnet **96**, which is fixably enclosed within the magnet housing **94**. The magnet housing **94** is rotatably coupled to the upper housing **84** and lower housing **85** by pivot pins **91**, **92**. The pivot pins **91**, **92** are cogs with at least a portion of their circumferences having teeth **103**, **104**. The magnet **96** is, e.g., a rare earth magnet or another suitably manufactured object that exhibits magnetic properties. The magnet **96** is positioned within the magnet housing **94** such that a first pole, here its south pole **97**, is disposed proximate to the upper housing **84** and a second pole, here its north pole **98**, is disposed proximate to the lower housing **85**. Bearings **107**, **108** are disposed along either side of the magnet housing **94** to hold the magnet housing **94** in place within the upper housing **84** and lower housing **85**.

An actuator rack or actuator member **86** is additionally partially housed within the upper housing **84** and lower housing **85**. The actuator rack **86** comprises a pushbutton **88** that extends from the upper housing **84**, lower housing **85**, and body **12** of the apparatus **10**. The actuator rack **86** includes two arms **89**, **90** having teeth **105**, **106** configured (e.g., sized, shaped and displaced) corresponding to the teeth **103**, **104** of the pivot pins **91**, **92** such that the teeth **105**, **106** of the arms **89**, **90** on each side of the actuator rack **86** mesh with the teeth **103**, **104** of the pivot pins **91**, **92** on the corresponding sides. While FIG. **5** illustrates an actuator **64** having two pivot pins **91**, **92** having teeth **103**, **104** and two arms **89**, **90** having teeth **105**, **106**, the actuator **64** could instead use one pivot pin and one corresponding arm, and the pivot pin may be internal to the housing **94** instead of extending outwardly from the housing **94**. Still other numbers and/or configurations of pivot pins and/or arms are possible. The arms **89**, **90** extend from the pushbutton **88** along a bottom portion of the actuator rack **86** that is slidably received by the lower housing **85**.

The teeth **105**, **106** of the arms **89**, **90** are configured to interact with the teeth **103**, **104** on the corresponding pivot pins **91**, **92** to rotate the pivot pins **91**, **92** when the pushbutton **88** slides within the body **12** to cause the magnet housing **94** to rotate between a first orientation (FIG. **2**) and a second orientation (FIG. **3**). The magnet housing **94** is rotated to the first orientation when the pushbutton **88** is in a default, unactuated position, and is rotated to the second orientation when the pushbutton **88** is in an actuated position.

The magnet **96** is disposed in the magnet housing **94** such that a pole **97** that is proximate to the plunger tip **67** while the magnet housing **94** is in the first orientation is the same as the pole **71** that is adjacent to the plunger tip **67**. In other words, as shown in FIG. **2**, the first orientation of the magnet housing **94** has a magnetic polarity of a bottom-facing pole **71** of the magnet **68** of the valve mechanism **62** opposite to a magnetic polarity of a pole **97** of the magnet **96** of the actuator **64** proximate to the magnet **68**, thereby resulting in a net attractive force between the magnets **68**, **96** and causing the plunger tip **67** of the valve mechanism **62** to be biased toward and positioned in the first, closed position. The teeth **103**, **104**, **105**, **106** are configured and the actuator member **86** has sufficient travel such that movement of the actuator member **86** will cause sufficient rotation of the magnet housing **94** to rotate a pole **98**, that is identical in polarity to the pole **71**, to become proximate to the plunger tip **67** compared to the pole **97** (i.e., the pole **98** is closer to the pole **71** than the pole **97** is to the pole **71**). In other words, as shown in FIG. **3**, the second orientation of the magnet housing **94** is rotated approximately 135 degrees relative to the first orientation, e.g., between about 125 and 145 degrees, or between about 115 and 155 degrees. Other amounts of rotation could be used, e.g., about 180 degrees. The amount of rotation of the magnet housing is chosen to cause the magnetic polarity of the bottom-facing pole **71** of the magnet **68** to match the magnetic polarity of the pole **98** of the second magnet **96** proximate to the magnet **68**, thereby resulting in a net repulsive force between the magnets **68**, **96** and to cause the plunger tip **67** of the valve mechanism **62** to be biased toward and positioned in the second, open position. Here, a straight arrow pointing from a center of the pole **98** through a pivot axis of the pivot pins **91**, **92** and through a center of the pole **97** would point toward the plunger tip **67** with the plunger **63** in the open position.

Return springs **99**, **100** are fixedly connected to an interior back portion of the lower housing **85** and disposed below the arms **89**, **90**. The return springs **99**, **100** operate to bias the pushbutton **88** into the default, unactuated position. The return springs **99**, **100** additionally provide resistive force against inward movement of the pushbutton **88** such that entry of the pushbutton **88** into the actuated position is conditioned upon the application of an amount of inward force upon the pushbutton **88** that exceeds the amount of resistive force provided by the return springs **99**, **100**. Although two springs are shown and used in this example, other quantities of springs (e.g., one, three, etc.) may be used.

In the example apparatus illustrated by FIGS. **2** and **3**, the actuator **64** is positioned below the valve mechanism **62** such that net attractive force between the magnets **68**, **96** with the pushbutton **88** in a default, unactuated position causes the plunger **63** to be positioned in the closed position and net repulsive force between the magnets **68**, **96** with the pushbutton **88** in an actuated position causes the plunger **63** to be positioned in the open position. Alternatively, the actuator **64** could be positioned above the valve mechanism **62**, in which case the effect of the magnets **68**, **96** on the position of the plunger **63** would be reversed. In this case, the polarization of the magnet **96** would be arranged to repel the plunger **63** to bias the plunger **63** into the closed position with the pushbutton **88** in the unactuated position and to attract the plunger **63** to bias the plunger **63** into the open position with the pushbutton **88** in the actuated position. Further, while the example apparatus illustrated by FIGS. **2** and **3** shows that the plunger **63** is positioned in the closed position while the pushbutton **88** is at rest and unactuated and in the open position while the pushbutton **88** is depressed and actuated, these states could be reversed by, e.g., changing the default orientation of one of the magnet **68** or the magnet **96**. Additionally, while the actuator **64** is illustrated as including a pushbutton **88**, other control devices, such as a slide, a dial, etc., could be used in addition to or in place of the pushbutton **88** without departing from the principles of operation described above. Preferably, the magnets **68**, **96** are composed of the same materials and exhibit approximately the same magnetic properties. However, the magnetic properties of the magnets **68**, **96** could alternatively vary in relation to each other without departing from the principles of operation discussed above.

According to a preferred embodiment, the apparatus **10** defines at least one sidearm passageway **110**. At least one or all of the sidearm passageways **110** are disposed within the body **12** of the apparatus **10** such that the same are fluidly connected to the mixing chamber **40** at generally the median or midsection **46** thereof. Along these lines, and as more clearly illustrated in FIG. **6**, sidearm passageways **110** interconnect with the mixing chamber **40** at a point below the ceiling **44** of the mixing chamber. Here, the sidearm passageways **110** are positioned such that they are approximately equidistant from the floor **42** and ceiling **44** of the mixing chamber **40**.

In the example apparatus shown in FIG. **6**, two sidearm passageways **110** are disposed within a body **12** of the apparatus **10**. The passageways **110** are disposed in a common plane, i.e., a single imaginary plane can be drawn through both of the passageways **110**. Here, with the body **12** being rotationally symmetric, the passageways **110** are diametrically opposed. Each sidearm passageway **110** comprises an outer opening that is open to the atmosphere and enables the entry of atmospheric gases into the apparatus **110** and an inner opening that opens into the mixing chamber **40** and enables mixing of the atmospheric gases within the mixing chamber **40** with at least one other fluid flowing through the apparatus **10**. In the example apparatus shown by FIG. **6**, the sidearm passageways **110** are positioned at an angle substantially parallel with a bottom edge of the apparatus **10**. In an alternative example illustrated by FIG. **7**, the sidearm passageways **110** are positioned at an upward angle relative to the bottom edge of the apparatus **10**. For instance, the positioning of the sidearm passageways **110** as shown in FIG. **7** could be utilized to inhibit a liquid flowing downwardly through the apparatus **10** from escaping through the sidearm passageways **110**, and/or for other purposes. Relative angles at which the sidearm passageways **110** are positioned need not be uniform and could be varied such that, e.g., a first sidearm passageway **110** is positioned as shown in FIG. **6** and a second sidearm passageway **110** is positioned as shown in FIG. **7**.

By arranging the interconnection between the sidearm passageways **110** and mixing chamber **40** as shown in FIGS. **6** and **7**, the second fluid is thus drawn into and allowed to mix with the first fluid passing into the mixing chamber **40**. Here, the mixing chamber **40** has a generally circular cross section and is configured to have a greater diameter relative to the bottom **34** of the transition passageway **30** and the top **52** of the exit chamber **50**. This relative diameter, coupled with the introduction of at least one second fluid at substantially the mid portion **46** of the mixing chamber **40**, may enable a substantially greater volume of at least one second fluid to be drawn into the fluid flow, which may as a consequence produce a substantially more thorough interaction between the fluids to thus create a resultant mixture having a higher degree of homogeneity when the combined fluids pass through the apparatus **10** relative to the mixing of fluids via conventional Venturi devices.

While FIGS. **6** and **7** illustrate example apparatuses having two sidearm passageways **110** extending horizontally between a mixing chamber **40** and an apparatus body **12**, other numbers and/or configurations of the sidearm passageways **110** could be used. For instance, an apparatus can be provided with one sidearm passageway **110**, or three or more sidearm passageways. Accordingly, although depicted in FIGS. **6** and **7** as having two diametrically opposed sidearm passageways **110** and associated dedicated openings through which at least one second fluid may be introduced, various design changes and/or modifications of the passageway design may be used.

The apparatus **10** may be formed as part of a housing, as shown in FIG. **1**, or may otherwise be incorporated as part of a fitting or incorporated as part of a tubular pipe structure. The body **12** of the apparatus **10** may be formed as a single structure, or as multiple (e.g., two) structures which are fixedly connected to each other, e.g., via gluing, sonic welding, press fitting, or any other suitable joining technology whereby a fluid- (gas- or liquid-)tight seal is preferably achieved. The various components of the fluid flow regulator **60**, including the valve mechanism **62**, the actuator **64** and the component parts thereof, can be disposed within the body **12** via gluing, sonic welding, press fitting the component parts into recesses disposed within the body **12** for receiving the component parts, etc., prior to, during or after formation of the body **12**. For instance, as shown in FIG. **1**, the transition passageway **30** connecting the receptacle chamber **20** and the mixing chamber **40** can be fabricated as an outwardly cylindrical insert into which the first passageway is inlaid, and disposed within the body **12** during assembly of the apparatus **10**. With respect to the example apparatus shown in FIG. **1**, the transition passageway **30** is a frusto-conical or otherwise tapered passageway. Alternatively, referring to the example apparatus shown in FIG. **8**, the transition passageway **30** could be a non-tapered, cylindrical passageway. Other modifications to the transition passageway **30** and/or other sections **20**, **40** and **50** of the apparatus **10** are possible.

The apparatus **10** is preferably configured to assume a substantially vertical orientation, to thus enable only gravitational force and atmospheric pressure to cause fluid to flow sequentially through the sections **20**, **30**, **40** and **50**, as shown. The apparatus **10** may, however, be positioned horizontally or at other non-vertical angles and further may be receive fluids that are pressurized.

A variety of dimensions can be utilized in each of the various sections of the apparatus **10**. In one specific example, the following dimensions can be utilized: the receptacle chamber **20** has a rounded shape of any length that tapers non-linearly from a top diameter of approximately 39.4 mm to a bottom diameter of approximately 16.4 mm; the transition passageway **30** is a frusto-conical structure having a height of at least 11.3 mm and tapering to a bottom diameter of approximately 4.0 mm; mixing chamber **40** has a diameter of approximately 6.7 mm and a height of approximately 5.1 mm; two symmetrical, diametrically opposed sidearm passageways **110** have lengths of approximately 21.5 mm and diameters of approximately 2.6 mm and fluidly interconnect with the mixing chamber at approximately the mid portion thereof; and the exit chamber **50** is a frusto-conical passageway having a height of approximately 69.9 mm and tapering from a top diameter of approximately 4.0 mm to a bottom diameter of approximately 11.2 mm. Such dimensions, however, are merely one example of dimensions for a Venturi apparatus and other dimensions could be used.

Additionally, the apparatus **10** can be constructed using a variety of materials. Preferably, the apparatus **10** is constructed using non-toxic materials that will not dissolve or mix into fluids, such as wine or spirits, which flow through the apparatus **10**. More specifically, materials that can be utilized for construction of the various components of the apparatus **10** are as follows. The body **12** of the apparatus **10**, the plunger housing **65** and the upper housing **84** and lower housing **85** of the actuator **64** include acrylate polymers, such as the NAS® 30® acrylic distributed by the PolyOne Corporation of Avon Lake, Ohio, or other plastics. The O-rings **74**, **81** can be constructed using silicone or similar materials. The plunger **63**, including the magnet housing **66**, the cap **72** and the plunger tip **67**, as well as the bearings **107**, **108** and magnet housing **94** of the actuator **64** can be constructed using polypropylene or other plastics as well stainless steel or other suitable metals. The magnets **68**, **96** can be composed of an alloy of neodymium and iron or any other suitable alloy having magnetic properties. Further, the magnets **68**, **96** can be nickel plated or coated with another suitable material. The actuator member **68** can be constructed using acrylonitrile butadiene styrene (ABS) polymers or other plastics. Other materials could also be utilized in addition to, or in place of, the materials listed above. Additionally, paints, dyes, pigments or the like could be applied to one or more component parts of the apparatus **10**.

The apparatus **10** may be configured to facilitate the mixture of fluids, whether liquid or gas, potable or non-potable. Examples of fluids that preferably can be utilized in association with the apparatus **10** include, but are not limited to, alcoholic beverages such as wine or spirits, nonalcoholic beverages, non-potable liquids such as industrial chemicals, atmospheric or non-atmospheric gases, etc.

Referring to FIG. **9**, with further reference to FIGS. **1-8**, a process **200** of aerating a liquid includes the stages shown. The process **200** is, however, an example only and not limiting. Alterations to the process **200** as shown and described are possible.

At stage **202**, the Venturi apparatus **10** is disposed above a receiving container, such as a wine glass or other glass, a carafe, etc. As described above, the Venturi apparatus **10** may be open to the atmosphere, or it may be fluidly connected to a container containing the liquid to be aerated.

At stage **204**, a liquid, such as an alcoholic beverage including but not limited to wine or spirits, is poured into the entrance portion **120** of the Venturi apparatus **10**. Preferably, the Venturi apparatus **10** is held vertically or near vertically and the liquid is poured downward into the entrance portion **120** of the Venturi apparatus **10** such that flow of the liquid through the Venturi apparatus **10** occurs due to gravitational force and atmospheric pressure without the influence of other outside forces, such as forces resulting from injection of the liquid through the Venturi apparatus **10**.

At stage **206**, flow of the liquid from the entrance portion **120** into the mixing chamber **40** fluidly connected to the entrance portion **120** is inhibited by the plunger **63** of the valve mechanism. Here, the plunger **63** is received within the body **12** of the Venturi apparatus **10**, thereby substantially obstructing the flow of the liquid out of the entrance portion **120** and into the mixing chamber **40**.

At stage **208**, the actuator **64** housed at least partially within the Venturi apparatus **10** is actuated to selectively permit the flow of the liquid from the entrance portion **120** to the mixing chamber **40**. Here, the plunger **63** is magnetically biased away from reception by the entrance portion **120** by the actuator **64**, causing the liquid to flow from the entrance portion **120** into the mixing chamber **40**. Atmospheric gases are drawn into the Venturi apparatus **10** due to the liquid flowing through the mixing chamber **40** to produce a pressure differential between the mixing chamber **40** and the region external and adjacent to an outer surface of the body **12** (i.e., with the pressure in the mixing chamber **40** being lower than the pressure outside the apparatus **10**). The atmospheric gases comingle and mix with the liquid in the mixing chamber **40** to produce a mixture of the liquid and atmospheric gases.

At stage **210**, the resultant aerated liquid flows from the Venturi apparatus **10** (e.g., due to gravity) through the exit chamber **50** and is received by the receiving container disposed below the Venturi apparatus **10**.

Additional modifications may be made. Thus, the particular combinations of parts and steps described and illustrated herein represent only certain example configurations and/or uses, and do not serve as limitations of alternative devices and

methods. Venturi apparatus may be operative to be utilized as stand-alone devices or otherwise incorporated as part of an integrated process and capable of widespread utilization.

What is claimed is:

1. A Venturi apparatus for facilitating the mixture of two or more fluids, the Venturi apparatus comprising:

a body defining:

a receptacle chamber configured to receive a first fluid;

a transition passageway disposed below and in fluid communication with the receptacle chamber and configured to receive the first fluid from the receptacle chamber;

a mixing chamber disposed below and in fluid communication with the transition passageway and configured to receive the first fluid from the transition passageway, wherein a top cross-sectional area of the mixing chamber is greater than a bottom cross-sectional area of the transition passageway; and

a sidearm passageway in fluid communication with the mixing chamber and extending to an outer surface of the body, and configured to allow at least a second fluid to pass from an exterior of the body through the sidearm passageway into the mixing chamber; and

a fluid flow regulator connected to the body and configured to affect a flow of the first fluid from the receptacle chamber into the mixing chamber, wherein the fluid flow regulator comprises a valve mechanism configured to selectively engage the body to inhibit flow of the first fluid from the receptacle chamber into the mixing chamber;

wherein the valve mechanism comprises a plunger housing fixedly mounted to the body and a plunger slidably coupled with the plunger housing, wherein the plunger housing defines a path of movement of the plunger;

wherein the plunger housing comprises a guide portion and a retainer portion connected to and disposed above the guide portion; and

wherein the retainer comprises a plurality of horizontal prongs which extend over the plunger to restrict vertical travel of the plunger as the plunger moves along the path of movement.

2. The Venturi apparatus of claim **1** wherein the receptacle chamber, the transition passageway and the mixing chamber are configured to pass the first fluid therethrough with the receptacle chamber, and the transition passageway and the mixing chamber are disposed in vertical alignment and the first fluid is subjected to gravity.

3. The Venturi apparatus of claim **1** wherein the plunger is positionable within the plunger housing in a closed position, in which the plunger engages at least a portion of a wall of the transition passageway to substantially obstruct fluid flow through the transition passageway and into the mixing chamber, and an open position, in which the plunger is displaced from the wall of the transition passageway to permit flow of the first fluid through the transition passageway and into the mixing chamber.

4. The Venturi apparatus of claim **3** wherein the plunger comprises a plunger tip providing a bottom surface of the plunger and having a shape corresponding to the at least a portion of the wall of the transition passageway and a cross sectional area greater than a cross sectional area of the at least a portion of the transition passageway.

5. The Venturi apparatus of claim **1** wherein the fluid flow regulator comprises a valve mechanism and an actuator that is physically separate from the valve mechanism and is configured to actuate the valve mechanism contactlessly, without direct physical contact between the actuator and the valve mechanism.

6. The Venturi apparatus of claim **1** wherein the sidearm passageway is a first sidearm passageway, the body further defining a second sidearm passageway, the first and second sidearm passageways being disposed within the body aligned along a common plane and fluidly connected to a median of the mixing chamber, wherein each of the plurality of sidearm passageways comprises an outer opening that is open to the atmosphere and permits entry of atmospheric gases and an inner opening that opens into the mixing chamber.

7. The Venturi apparatus of claim **1** wherein the receptacle chamber is open to the atmosphere.

8. The Venturi apparatus of claim **1** wherein the body further defines an exit chamber disposed below and in fluid communication with the mixing chamber and configured to receive a mixture of the first fluid and the second fluid from the mixing chamber, wherein a bottom cross-sectional area of the mixing chamber is greater than a top cross-sectional area of the exit chamber.

9. A Venturi apparatus for facilitating the mixture of two or more fluids, the Venturi apparatus comprising:

a body defining:

a receptacle chamber configured to receive a first fluid;

a transition passageway disposed below and in fluid communication with the receptacle chamber and configured to receive the first fluid from the receptacle chamber;

a mixing chamber disposed below and in fluid communication with the transition passageway and configured to receive the first fluid from the transition passageway, wherein a top cross-sectional area of the mixing chamber is greater than a bottom cross-sectional area of the transition passageway; and

a sidearm passageway in fluid communication with the mixing chamber and extending to an outer surface of the body, and configured to allow at least a second fluid to pass from an exterior of the body through the sidearm passageway into the mixing chamber; and

a fluid flow regulator connected to the body and configured to affect a flow of the first fluid from the receptacle chamber into the mixing chamber, wherein the fluid flow regulator comprises a valve mechanism configured to selectively engage the body to inhibit flow of the first fluid from the receptacle chamber into the mixing chamber;

wherein the valve mechanism comprises a plunger housing fixedly mounted to the body and a plunger slidably coupled with the plunger housing, wherein the plunger housing defines a path of movement of the plunger;

wherein the fluid flow regulator further comprises an actuator that is physically separated from the plunger and is configured to actuate the plunger to slide relative to the plunger housing;

wherein:

the plunger comprises a first magnet; and

the actuator comprises a second magnet rotatably coupled to the body.

10. The Venturi apparatus of claim **9** wherein the actuator further comprises an actuator member movably coupled to the body and configured to cause, when moved relative to the body, the second magnet to rotate from a first orientation biasing the plunger into a closed position to a second orientation biasing the plunger into an open position.

11. The Venturi apparatus of claim **10** wherein: the actuator further comprises an actuator housing and a magnet housing containing the second magnet;

the actuator member is movably coupled to the actuator housing and comprises a plurality of arms disposed along a bottom portion of the actuator member and slidably coupled to an interior of the actuator housing;

the actuator member is positionable relative to the actuator housing in an actuated position and an unactuated position; and

the magnet housing is pivotably coupled to the actuator housing by a plurality of pivot pins extending from opposing sides of the magnet housing.

12. The Venturi apparatus of claim **11** wherein:

each of the plurality of pivot pins includes cogs having first teeth disposed along at least a portion of the circumference of the pin; and

each of the plurality of arms comprises second teeth that are sized, shaped and disposed corresponding to the first teeth such that the first teeth mesh with the second teeth.

13. The Venturi apparatus of claim **12** wherein the second teeth of the arms are configured to interact with the first teeth of the pivot pins to rotate the pivot pins when the actuator member moves between the unactuated position and the actuated position, thereby rotating the second magnet between the first orientation when the actuator member is in the unactuated position and the second orientation when the actuator member is in the actuated position.

14. The Venturi apparatus of claim **13** wherein in the first orientation, the second magnet has a first pole closer to the plunger than a second pole, and in the second orientation has the second pole closer to the plunger than the first pole, the first pole having a magnetic polarity opposite to a magnetic polarity of a bottom pole of the first magnet.

15. The Venturi apparatus of claim **13** wherein the first teeth and second teeth are configured and the actuator member has sufficient travel relative to the pivot pins such that movement of the actuator member causes rotation of the second magnet between the first orientation and the second orientation.

16. The Venturi apparatus of claim **13** wherein the actuator further comprises a return spring configured and disposed to bias the actuator member into the unactuated position.

17. A Venturi apparatus for facilitating the mixture of a liquid with a gas, the Venturi apparatus comprising:

a body defining:

a receptacle chamber configured to receive the liquid;

a mixing chamber disposed below and in fluid communication with the receptacle chamber and configured to receive the liquid; and

a sidearm passageway in fluid communication with the mixing chamber and extending to an outer surface of the body, and configured to allow the gas to pass from an exterior of the body adjacent to the outer surface into the mixing chamber; and

flow regulating means for selectively inhibiting flow of the liquid from the receptacle chamber to the mixing chamber and for selectively permitting flow of the liquid from the receptacle chamber to the mixing chamber, the flow regulating means comprising valve means and actuating means for actuating the valve means, without physical contact with the valve means, to selectively inhibit or selectively permit flow of the liquid from the receptacle chamber to the mixing chamber;

wherein the actuating means comprises a first magnet coupled to the valve means and a second magnet coupled to an actuating member movably coupled to the body.

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